UNIVERSITY OF CALIFORNIA.

AGRICULTURAL EXPERIMENT STATION.

BULLETIN NO. 57.

Vintage Work and Instruction in the Viticultural Laboratory, 1886.

The vintage work in the Viticultural Laboratory of the University will be resumed during the first week of September next, substantially on the plan pursued during previous years, but with facilities greatly enlarged and improved. The general features of this work are outlined in the legislative act of 1880, which is here given for the information of persons interested:

The Provisions of the Act of 1880.

An Act for the Promotion of the Viticultural Interests of the State. (Approved April 15, 1880. Stats. of Cal., 1880, p. 53.)

Section 8. And for the further promotion of viticultural interests, it shall be the duty of the Board of Regents of the University of California to provide for special instruction to be given by the Agricultural Department of the University, in the arts and sciences pertaining to viticulture, the theory and practice of fermentation, distillation and rectification, and the management of cellars, to be illustrated by practical experiments with appropriate apparatus; also, to direct the Professor of Agriculture, or his assistant, to make personal examinations and reports upon the different sections of the State adapted to viticulture; to examine and report upon the woods of the State procurable for cooperage, and the best methods of treating the same; and to make analysis of soils, wines, brandies and grapes, at the proper request of citizens of the State; also, to prepare comprehensive analyses of the various wines and spirits produced from grapes, showing their alcoholic strength and other properties, and especially any deleterious adulterations that may be discovered. The Regents shall also cause to be prepared, printed and distributed to the public, quarterly reports of the professor in charge of this work, relating to experiments undertaken, scientific discoveries, the progress and treatment of the phylloxera and other diseases of the vine, and such other useful information as may be given for the better instruction of viticulturists.

Under the provisions of this act, work has been carried on at the University since its passage, so far as the funds available for the purpose permitted. Heretofore, the laboratory and other working appliances and accommodations have been so limited that the vintage work has been severely cramped and under great disadvantages, especially as to the very small scale upon which everything had to be done. By the aid of the legislative appropriation made in 1885, which only became available during the present year, not only has the laboratory been so enlarged as to afford room for a number of special students, but the cellar room required for practical work has been tripled by the addition of two basement rooms and a subcellar, 25 by 46 feet, substantially built of brick laid in cement, with concrete floor, well drained; giving full control of temperature in the fermentation and after-treatment of wines. The larger scale and ampler means with which the experimental and illustrative work can now be carried on will render the methods and results more directly applicable to the work of wineries.

Plan of the Work.

Although the methods of work pursued in the viticultural laboratory, and the practical objects sought to be attained, have been set forth in previous publications, it is appropriate that a summary statement of the same, made in former bulletins, should here be repeated in substance.

The plan of work in the viticultural laboratory is based upon the obvious fact that "among the first necessities of the present situation of California wines in the world's market is the establishment of more definite qualities and brands, resulting from a definite knowledge of the qualities of each of the prominent grape varieties, and of their influence upon the kind and quality of the wine, in blending before, or as the case may be, after fermentation; of the treatment required by each in the cellar, during the time of maturing, and finally, of the differences caused by difference of location, climate, etc., as well as by different treatment of the wines themselves during the first and after-fermentation."

"In the wine-producing countries of Europe this knowledge has been acquired by long experience; and chemical investigation has subsequently in a great measure ascertained the natural conditions upon which the attainment of certain results in wine-making depends. The principles thus evolved can be applied to new conditions, such as those existing in California, and thus save to a great extent the laborious and costly experimenting which has been gone through heretofore, by formulating into generally intelligible rules the knowledge which otherwise usually remains the trade secret of a few experts."

"It should be fully understood and remembered that while peculiarities and defects shown by analysis are perfectly definite indications as to the conditions that *must* be fulfilled in a successful blend, yet analysis cannot as yet take cognizance of the delicate and almost intangible flavors or 'bouquets,' which must likewise be made to harmonize, in order to satisfy a cultivated palate. To that extent the determination of the proper blends must always remain with the expert wine-taster, but the work of the latter is im-

mensely facilitated by being informed, through the analysis, of the prominent chemical peculiarities, which in any case must be taken into consideration, and which ordinarily are left to laborious and more or less blind guessing or experimenting."

In conformity with these views, in past years a number of the more prominent grape varieties already cultivated in the State have been made into both red and white wines each,* and each thereafter subjected to the test both of chemical analysis and taste. The chemical composition of the fresh juice or must is, of course, ascertained by analysis in all cases. The results of the work done in former years have been given to the public in reports and bulletins heretofore published,† and the importance of this method of determining in advance the probable outcome of heavy pecuniary investments has seemed so obvious as to induce every season numerous applications for the examination of grapes and wines from different localities. The working and examination of 40 varieties of newly-imported grapes for the Natoma Water and Mining Company, in 1884, has been fruitful of results, in respect to the intelligent selection of varieties for new planting or grafting; yet, in consequence of the inadequate means and appliances then at command, these results have not been as full as they otherwise would have been. It is expected that during the present season at least a portion of this work will be repeated under more favorable conditions; moreover, grapes of about 40 varieties from the experimental vineyard at Cupertino, grafted in 1884, and now in good bearing, will come under treatment. Comparative experiments with different methods of fermentation under conditions rigorously controlled, as they now can be, will give students an excellent opportunity for practical observation and for the study of the causes that lead to certain definite results.

There prevails not uncommonly among vintners a prejudice to the effect that small-scale experiments in wine-making can but remotely lead to a correct estimate of the results to be expected on the large scale, and that they frequently mislead to such an extent as to cause grave financial losses. Were this necessarily true, of course there would be little use for laboratory experiments on any scale practicable outside of a winery.

What *is* true, however, is that small-scale experiments do not lead to correct results when made in large cellars alongside of the large quantities there treated. This cannot be otherwise, from precisely the same causes which have led to the almost universal abandonment of the immense tanks used in the older wineries of the State, in favor of those not exceeding much the capacity of 2000 gallons. If the 8000-gallon tank yielded poor results when placed in the same conditions as the 2000-gallon ones, it is obvious that there must be a similar difference, *at least*, between the 2000-gallon tank on the one hand and the 5 or 10 gallon experimental keg on the other.

These differences are due mainly to the different temperature-conditions under which the fermentation takes place. When the fermenting masses are large the temperature will rise proportionally higher—sometimes so high as to actually check fermentation, making it difficult to revive it, and leading to the ultimate setting-in of abnormal fermentation, resulting in "milk-sour" wines. When the masses are very small, on the contrary, the regular course of the fermentation is liable to be interfered with by such small variations of temperature in the fermenting-rooms as will leave masses of proper amount, say 1000 to 2000 gallons, almost unaffected. Hence a 10-gallon keg in a cellar and temperature adapted to the proper fermentation of large packages can only accidentally furnish results correctly representing large-scale operations.

It is quite otherwise in a cellar of which the temperature can be regulated at will, and with special adaptation to small packages; when the latter will furnish wines closely corresponding to those that will be produced under correct practice on a large scale. It need hardly be said that the temperature must be kept higher than would be admissible in a cellar containing 2000-gallon packages.

One advantage of considerable practical importance is, however, secured by the use of small packages, viz., that the wines mature much more quickly than in larger ones, and thus results approximating those usually attained in two years may be seen and judged at the end of one year.

Course of Instruction in Viticulture and Vinification.

Students taking this course, which may be extended until Christmas recess, will, during the vintage season, occupy the greater part of their time in actual work in the viticultural laboratory, under the direct instruction of Assistants Jaffa and Colby. In addition, from two to four lectures on the principles and practice of vinification and wine analysis will be given them by Professor Hilgard.

It is very desirable that students taking this course should have some general knowledge, at least, of chemistry and physics; and some preliminary experience in winery practice will be very advantageous.

Applications for this course should be addressed as soon as possible to Prof. Hilgard, at Berkeley, in order that the proper laboratory arrangements may be made before the brunt of the vintage comes. The lecture course will begin at the opening of the University session, September 17th, but, according to the season, the laboratory work may begin sooner, and students applying will be promptly notified of the fact. Instruction is gratuitous, but a charge, varying, according to actual breakage of apparatus and use of chemicals, from a minimum of one dollar per month upward, is made to laboratory students.

*In the case of white grapes, of course, "red" implies simply the mode of treatment, viz.: Fermenting on the skins as in the making of red wines properly so called.

†The "Report of Viticultural Work for the years 1883-1884, with Notes on the Vintage of 1885,' 210 pages, published December, 1885, can be had on application to the College of Agriculture, at Berkeley.

Suggestions to Senders of Grapes, Wines, etc.

Grape-growers and wine-makers are invited to send sample lots of grapes for analysis and experimental wine-making. As a rule, each grape variety will be made into wine separately; the analysis of the must is made on the day of crushing, and will, if so desired, be at once communicated to the sender. That of the wine must, of course, be delayed until the latter has acquired a reasonable degree of maturity, after several rackings. But reports on special points that may be ascertained sooner will be sent if desired.

Experimental blends will also be made either in accordance with the request of growers, or such as examination or previous experience may seem to render desirable.

Ready-made wines or brandies of which the analysis or other examination is desired will receive attention in the order of their receipt at Berkeley.

All work is, of course, done gratuitously, transportation charges being ordinarily paid by the sender. It is hardly necessary to say that, other things being equal, the larger the quantity of grapes worked, the more certainly and nearly will the result correspond to that which may be expected on the large scale. In the case of rare grapes, a few pounds, carefully treated, may be made to give fair results; but it is very desirable that the amount sent for experimental working should in no case be less than that which will yield five gallons of finished wine—say (considering the losses consequent from transportation, amounts required for analysis, frequent racking, etc.) 100 pounds; but twice that amount is preferable, and of some of the more important varieties, 20-gallon lots will be made this season.

Wine grapes, being usually very juicy and of delicate texture, should be packed with especial care in small shallow boxes holding not exceeding 20 pounds each, and preferably in layers with grape leaves between. In no case should packing paper be used, as it causes a rapid production of mold, spoiling both the grapes and the experiment. Persons not having proper boxes may have them sent to them by express from the laboratory by giving timely notice. Send promptly advice of shipment, whether by express or freight. Address University of California, care of Prof. Hilgard; if by express, to Berkeley; if by freight, to West Berkeley depot.

E. W. HILGARD.

Berkeley, Aug. 20, 1886.